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times as much to the weight of k as do those in zone II. The mean result for k should therefore be sensibly the same as the values for zones I and III when treated separately, as proves to be the case ($k = 0.99$, 96 , and 96 , respectively). The weight of the inclination, on the other hand, is derived largely from the observations of the equatorial zone. Moreover, i is calculated after k has been found, so that the conditions in the uniform-field solution are analogous to those of the first approximation of zone II. In this approximation the equatorial observations combined with $x' = 1.00$ —the equivalent of $k = 0.99$ —gave $i = 6.7$, which is nearly the same as the value found from all the data. The measures of zones I and III combined with $k = 0.99$, as we know from the zonal analysis, must lead to relatively small values for i , amounting to about 4° . The mean therefore lies between these two extremes, with a preponderance of weight in zone II. This accounts for the value of 6.0 originally found—a mean result which is in excess of all the inclinations found by treating the zones separately. It is only when the equatorial observations are discussed by themselves that the true value of k for this region reveals itself or has any appreciable influence upon the solution; but when once found the inclination is necessarily decreased.

We are under great obligation to Miss Wolfe of the Computing Division who has rendered much assistance with the extensive numerical calculations required for the discussion of the data.

¹Seares, F. H., van Maanen, A., and Ellerman, F., these PROCEEDINGS 4, 1918, (4-9).

ON THE PROBLEM OF THE PRODUCTION OF FAT FROM PROTEIN IN THE DOG

BY H. V. ATKINSON AND GRAHAM LUSK

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Read before the Academy, April 28, 1919

In eight experiments in a series of thirteen, after giving meat in large quantities (700 to 1300 grams) to a dog weighing 11 kgm., the respiratory quotients during the height of protein metabolism were between 0.793 and 0.800. A calculation showed that under these conditions the retained carbon residue of the protein metabolized was held back in such a form that, had it been oxidized, the respiratory quotient of this retained pabulum would have been 0.85. This would represent the oxidation of material half of whose calories were composed of fat and half of carbohydrate. The dog showed quotients of 0.82 and above only after the larger quantities of meat were given (1000 grams or more). It was extremely difficult to induce the dog to take meat in sufficient quantity to indicate a considerable production of fat from protein. Incidentally it was observed that the basal metabolism of a dog fed with meat in large quantity for a time and then caused to revert to a 'standard diet'

(meat, 100 grams; lard, 20 grams; and biscuit meal, 100 grams) remained persistently (even after $2\frac{1}{2}$ weeks) at a higher level than had obtained prior to the meat ingestion. This confirms F. G. Benedict's idea of a higher basal metabolism in the presence of 'surplus' cellular nitrogen, or the 'improvement quota' of protein according to Rubner's suggestive terminology. When meat was given after the partial depletion of the body cells of their 'improvement quota', protein was retained in greater measure, less protein was metabolized and the heat production was therefore lower than on a subsequent day (experiments 46, 47; 51, 54).

The following table gives the method of calculation followed:

<i>Experiment 55. N in urine per hour = 1.58 grams</i>					
	<i>grams</i>		<i>grams</i>		
N-CO ₂	14.77	N-O ₂	13.35	N-cals.....	41.89
Resp. CO ₂	<u>11.42</u>	Resp. O ₂	<u>10.42</u>	Deposit cals.....	<u>9.92</u>
Dif.....	3.35		2.93	Indirect cals.....	31.97
				Direct cals.....	31.98

R. Q. of deposit = 0.83

R. Q. per hour—0.81, 0.74, 0.80, 0.84. R. Q. for whole period = 0.797

In the above table:

N-CO₂ is the amount of CO₂ derivable from the protein metabolism during an hour.

N-O₂ is the amount of O₂ necessary to oxidize the protein metabolized in one hour.

Resp. CO₂ and Resp. O₂ are the amounts of CO₂ and O₂ which were actually respired during an hour.

The difference represents (1) the CO₂ which would have been expired had all the retained carbon of the protein metabolism been oxidized and (2) the O₂ which would have been employed in that process. The relation between the volumes of these two gases indicates that the material retained and un-oxidized would have yielded a respiratory quotient of 0.83, which indicates the retention of a pabulum, approximately half of the calories of which were derived from fat and half from glucose.

N-cals. is the quantity of heat which would have been eliminated by the dog had all the protein metabolized by the dog been completely oxidized. From this is subtracted the number of calories estimated to have been retained as a mixture of fat and glucose aforesaid. The difference represents the calories as calculated by *indirect calorimetry*, which in this case agrees exactly with those directly measured by the calorimeter by the method of *direct calorimetry*.

The following summary of results is appended.

Effect of meat ingestion on hourly metabolism

EXP. NO.	DATE	FOOD	NUMBER OF HOURS	URINE N	R. Q.	CALORIES		C DEPOSITED	R. Q. OF DEPOSIT	HOURS AFTER FOOD
						Indirect	Direct			
	1919									
27	Feb. 6	Basal	2	0.15	0.84	15.92	16.08			(Weight = 11.24 kgm.)
29	Feb. 17	Meat, 700 g.	3	1.40	0.820	29.97	30.01	0.60	0.73	4, 5, 6
30	Feb. 18	Meat, 800 g.	3	1.46	0.800	31.47	32.75	0.66	0.83	4, 5, 6
31	Feb. 19	Meat, 900 g.	3	1.47	0.787	34.33		0.48	0.96	4, 5, 6
32	Feb. 20	Meat, 1000 g.	2	1.46	0.797	34.27	34.50	0.42	0.87	4, 5
			2	1.46	0.820	35.50	37.20	0.23	0.62	6, 7
33	Feb. 21	Meat, 1100 g.	2	1.45	0.831	31.65	31.36	0.56	0.68	4, 5
			2	1.45	0.843	35.28	34.54	0.25	0.49	6, 7
34	Feb. 24	Meat, 1080 g.*	2	1.57	0.800	34.00	34.12	0.70	0.83	4, 5
35	Feb. 26	Basal	3	0.27	0.82	19.74	19.59			(Weight = 12.07 kgm.)
36	Feb. 27	Basal	3	0.20	0.83	18.25	17.16			
37	Feb. 28	Basal	2	0.17	0.85	17.30	16.95			
38	Mar. 1	Basal	2	0.15	0.82	18.21				
39	Mar. 3	Basal	3	0.15	0.85	17.57	17.22			
43	Mar. 12	Basal	2	0.15	0.81	17.08	16.99	0		(Weight = 11.50 kgm.)
46	Mar. 17	Meat, 1200 g.	3	1.02	0.796	26.57	28.10	0		5, 6, 7 after 1 day's fast
47	Mar. 18	Meat, 800 g.	3	1.44	0.795	29.90	30.77	0.77	0.84	5, 6, 7
48	Mar. 19	Meat, 800 g.	4	1.35	0.793	29.37	30.27	0.61	0.86	5 to 8
49	Mar. 22	Basal	2	0.23	0.79	17.72	17.54			
50	Mar. 24	Basal	2	0.16	0.84	17.26	16.87			
51	Mar. 28	Meat, 800 g.	4	1.02	0.795	27.04	27.52			5 to 8 after 4 days' fast
54	Apr. 15	Meat, 800 g.	4	1.41	0.794	31.07	30.57	0.59	0.86	5 to 8
55	Apr. 16	Meat, 1000 g.	4	1.58	0.797	31.97	31.98	0.91	0.83	5 to 8
56	Apr. 19	Meat, 1300 g.	4	1.47	0.826	31.62	33.25	0.59	0.71	5 to 8 after 1 day's fast

* Standard diet at 5 p.m. and thereafter daily until March 15.

ON THE TWIST IN CONFORMED MAPPING

BY T. H. GRONWALL

RANGE FIRING SECTION, ABERDEEN PROVING GROUND

Communicated by E. H. Moore, April 29, 1919

Note II on Conformal Mapping under aid of Grant No. 207 from the Bache Fund.

Let $w = w(z)$ be a power series in z , convergent for $|z| < 1$ and such that the circle $|z| < 1$ is mapped conformally on a *simple* (that is, simply connected and nowhere overlapping) region in the w -plane. By a linear transformation $w^1 = aw + b$, we may reduce $w(z)$ to the form $z + a_2z^2 + \dots + a_nz^n +$